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Project Summary

HVAC Systems as Emission Sources Affecting Indoor Air Quality: A Critical Review

Stuart Batterman and Harriet Burge

The study evaluates heating, ventilating, and air-conditioning (HVAC) systems as contaminant emission sources that affect indoor air quality (IAQ). Various literature sources and methods for characterizing HVAC emission sources are reviewed. Available methods include *in situ tests,* longitudinal and cross-sectional studies, and laboratory studies. A critique of the literature reveals that few studies are well-controlled, comprehensive, and quantitative. Significant gaps in the data are highlighted and procedures are suggested to improve the characterization of bioaerosol and volatile organic compound (VOC) emission sources. Based on the available literature, several HVAC components are cited fairly frequently as emission sources, and there is broad agreement regarding their significance. The components include biological growth and bioaerosol generation in the presence of moisture provided by air washers and other recirculating water systems, poor control of humidity, poorly designed humidifying systems, and inadequately maintained cooling coils and drip pans. IAQ problems appear to be exacerbated by dust accumulation and by the presence of fibrous insulation. Other problems include entrainment, migration, and infiltration of indoor and outdoor contaminants that are distributed to indoor spaces by the HVAC system. Good design and operation of HVAC systems, including the appropriate placement and maintenance of air intakes, building pressurization, and local exhaust in source areas, are all important. More limited data implicate dust (resulting from inadequate filtration and maintenance of filters) as a sink and secondary source for VOCs.

This Project Summary was developed by EPA's Air and Energy Engineering Research Laboratory, Research Triangle Park, NC, to announce key findings of the research project that is fully documented in a separate report of the same title (see Project Report ordering information back).

Purpose

Traditionally, heating, ventilating, and air-conditioning (HVAC) systems have been considered to be a part of the solution to indoor air quality (IAQ) problems. The provision of clean outdoor air to the occupied spaces by the HVAC system can remove airborne contaminants and dilute occupant-generated odors.

Recent studies indicate that the HVAC system itself can act as the source of indoor pollution in nonindustrial spaces. This literature review was undertaken to identify and evaluate HVAC systems as emission sources that affect IAQ.

General Description

The U.S. Environmental Protection Agency (EPA) and the American Society of Heating, Refrigerating and Air-Conditioning Engineers jointly funded a research project with the University of Michigan to identify and quantify sources of indoor air pollution from HVAC systems in nonindustrial buildings.

Sources were identified through the process of a literature review. Sources were quantified in various buildings on the Uni-

versity of Michigan campus. The report cites only the findings of the critical literature review.

Approach/Findings

The review focuses on contaminant sources and highlights sources and problems in HVAC systems. The literature reviewed included data and reviews in peer-reviewed journals, books and proceedings.

Based on the available literature, many HVAC components can act as direct or indirect sources of particles and/or volatile organic chemicals. These can affect IAQ under some conditions. Most prominent is the occurrence of biological growth and bioaerosol generation in the presence of moisture provided by air washers and other recirculating water systems.

These problems appear to be exacerbated by dust accumulation and infiltration of outdoor air contaminants that are distributed to occupied spaces by the HVAC system.

A number of studies describe the importance of good fundamental HVAC system design and operation, including the appropriate placement and maintenance of air intakes, building pressurization, and local exhaust in source areas.

Many sources and problems related to indoor air contaminants and HVAC systems have been identified as having the potential to critically affect IAQ. No single study (or collection of studies) of HVAC emission sources was comprehensive and examined and isolated pollutant contributions from major HVAC components.

Stuart Batterman is with the University of Michigan, Ann Arbor, MI 48109; and Harriet Burge is with Harvard University, Boston, MA 02115.
***Russell N. Kulp** is the EPA Project Officer (see below).*
The complete report, entitled "HVAC Systems as Emission Sources Affecting Indoor Air Quality: A Critical Review," (Order No. PB95-178596; Cost: $19.50, subject to change) will be available only from
National Technical Information Service
5285 Port Royal Road
Springfield, VA 22161
Telephone: 703-487-4650
The EPA Project Officer can be contacted at
Air and Energy Engineering Research Laboratory
U.S. Environmental Protection Agency
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